Standards and Benchmarks

Strand I: Scientific Thinking and Practice

Standard I: Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.

- **K-4 Benchmark I**: Use scientific methods to observe, collect, record, analyze, predict, interpret, and determine reasonableness of data.
- **K-4 Benchmark II**: Use scientific thinking and knowledge and communicate findings.
- **K-4 Benchmark III**: Use mathematical skills and vocabulary to analyze data, understand patterns and relationships, and communicate findings.
- K- 1. Observe and describe the relative sizes and characteristics of objects (e.g. bigger, smaller)
- **5-8 Benchmark I**: Use scientific methods to develop questions, design and conduct experiments using appropriate technologies, analyze and evaluate results, make predictions, and communicate findings.
- **5-8 Benchmark II**: Understand the processes of scientific investigation and how scientific inquiry results in scientific knowledge.

Strand II: Content of Science

Standard III: Earth and Space Science: Understand the structure of Earth, the solar system, and the universe, the interconnections among them, and the processes and interactions of the Earth's systems.

- **K-4 Benchmark II**: Know the structure and formation of Earth and its atmosphere and the processes that shape them.
- 2nd- 1. Know that rocks have different shapes and sizes (e.g, boulders, pebbles, sand) and that smaller rocks result from the breaking and weathering of larger rocks.
 - 2. Understand that rocks are made of materials with distinct properties.

- **K-4 Benchmark II**: Know the structure and formation of Earth and its atmosphere and the processes that shape them. (continued)
- 3rd- 1. Know that Earth's features are constantly changed by a combination of slow and rapid processes that include the action of volcanoes, earthquakes, mountain building, biological changes, erosion, and weathering.
- 4th- 1. Know that the properties of rocks and minerals reflect the processes that shaped them (i.e. igneous, metamorphic, and sedimentary rocks).
- **5-8 Benchmark II**: Describe the structure of Earth and its atmosphere and explain how energy, matter, and forces shape Earth's systems.
- 6th- 1. Know that Earth is composed of layers that include a crust, mantle, and core.
 - 3. Know that sedimentary, igneous, and metamorphic rocks contain evidence of the materials, temperatures, and forces that created them.
 - 8. Understand the history of Earth and how information about it comes from layers of sedimentary rock, including: sediments and fossils as a record of a very slowly changing world and evidence of asteroid impact, volcanic and glacial activity.
- 7th- 1. Understand how the remains of living things give us information about the history of Earth, including: layers of sedimentary rock
- 8th- 1. Describe the role of pressure (and heat) in the rock cycle.

Vocabulary

geology- The scientific study of the origin, history, and structure of the earth.

geologists- (ge= earth, ology= study of) people who study rocks

igneous - rocks that are formed when *magma* cools and solidifies beneath the earth

magma- molten rock under the earth's crust

lava- magma that flows out at the earth's surface during volcanic activity

extrusive- a kind of igneous rock that is formed when magma cools and solidifies on the earth's surface

intrusive- a kind of igneous rock that is formed when magma cools and solidifies inside the earth.

sedimentary- rocks that are formed by the deposition of sediment sediment- loose material (organic or inorganic) that can harden into rock.

clastic- rocks are made up of particles like clay, silt, sand, and gravel that have formed from the breakdown of pre-existing rocks that are transported by some means to the site where they harden

nonclastic- rocks which have been organically or chemically formed at the site of deposition

metamorphic- rocks that are changed by heat, pressure, or chemicals rock- one or more minerals that make up the earth's crust

Extension Activities

Real learning takes place when a student makes connections and ties new information to ideas that they have previously learned. These activities provide a few ideas for reviewing and extending the science concepts that we introduce in the "It's a Small World" Science on Wheels program. We hope that you will find something here that helps tie science to other lessons in your classroom!

Earth Model

You need: two apples, a sharp knife, and a cutting board

What is the outside of the apple? (skin) What is inside an apple? (fruit) What is at the center? (core, seeds) Cut one apple in half vertically. Explain that although scientists have never seen deep inside the Earth, they believe that it has layers, like this apple. The crust of the Earth is like the skin; it covers the Earth and is thin. We live on the crust. The inside of the Earth is called the mantle, and it is like the fruit. It is much thicker than the crust. The center of the Earth is called the core, just as the center of the apple is called the core. Does the earth have a seed in the middle? (no!)

Cut the second apple in half horizontally. Compare the way the two cut apples look. The same thing can look different when we look at it from a different angle.

How is this apple different from the Earth? (shape isn't spherical, stem, color, composition, etc.)

Although this apple isn't exactly like the Earth, it can be used to explain the parts of the Earth that we can't see. The apple can be used as a model of the Earth.

Older students may be given (or shown) an apple and an orange (along with other fruits if you like). Cut the fruit in half horizontally and vertically. Which is a better model of the Earth? Why? Explain, using words or a diagram, how each part of the fruit is similar to the part of the Earth that it represents.

<u>Petrified!</u> (see worksheet)

concept: The properties of rocks are historical clues that give us information about how a rock was formed.

"Touch the earth and listen to the rocks
For they remember
They know and remember
all that has come to pass here." Lee Henderson

See student worksheet "Petrified"- This worksheet is meant to help students brainstorm and research the properties of rocks and the processes that shaped them. Guide students as needed. After students identify their rock, encourage them to review the rock cycle to see where their rock "fits." Encourage students to pretend that they are this rock (personification) and write as though they are telling their story. Use these questions to guide your thinking:

- 11) What kind of rock are you?
- 12)How old are you?
- (How old is the earth? How old are the mountains or rock layers in your area?)
- 13) What was your childhood like? How were you formed? How did you feel?
- 14) What gave you your shape? (erosion, humans)
- 15) What gave you your color? (specific minerals)
- 16) What gave you your texture? (cooling quickly form small crystals or bubbles smooth, shiny, crystals, cooling slowly- forms large crystals, sediment- sandy, heat and pressure)
- 17) What are your contributions or uses today?

(Student Worksheet)

Petrified				
Petrified comes from the Latin word petra meaning "rock." What does this word mean today?				
Pretend that you have been <u>petrified!</u> AAAAGGGGHHHH!!! Now, answer these questions as if you were a rock:				
1) What kind of rock are you?				
2) How old are you?				
3) Tell about your childhood. How were you formed? How did you feel?				
4) What gave you your shape?				
5) What gave you your color?				
6) What gave you your texture?				
7) What are your contributions or uses today?				

Petrified- Interview

Pretend that you (as the rock) is being interviewed. What questions would the interviewer ask? How would you answer? This could even be acted this out! Let a partner ask you (the rock) the questions. Shy? Set the rock on a table and hide behind it to "answer" the questions.

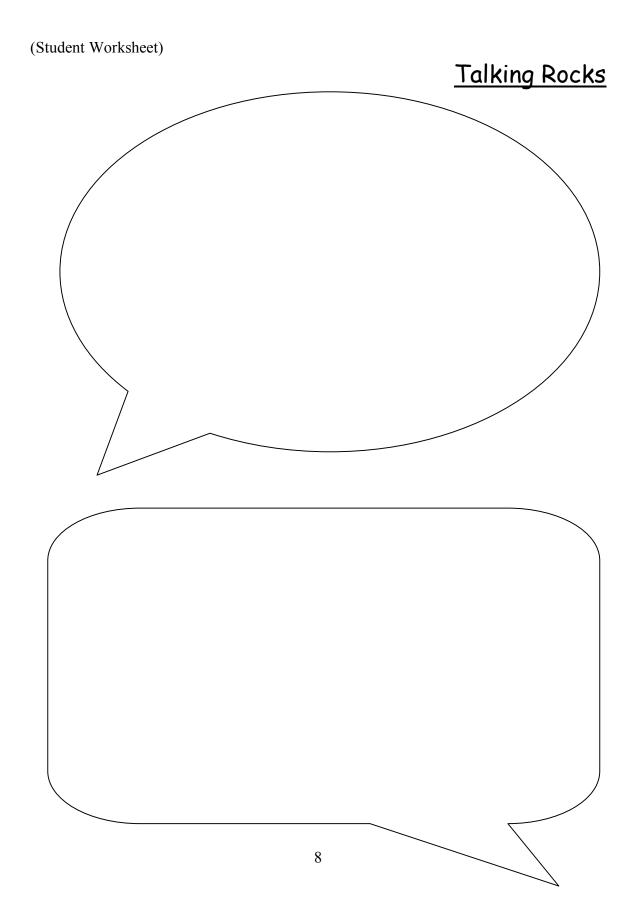
Petrified- First Person Narrative

Tell your story! Students could begin with a description of magma and go through the entire rock cycle: igneous, sedimentary, and metamorphic. Each kind of rock could be a paragraph—with transitions being the actions that transformed them!

<u>Petrified- Talking Rocks</u> (see worksheet)

If you were a talking rock, what would you say? Students can practice successfully using rock research information and personification together as they "speak" like a rock. Tell what kind of rock you are and how you were formed.

- **Bubbles can be copied on colored paper, with each color representing a different kind of rock: igneous, sedimentary, metamorphic.
- **The speaking "bubbles" could be displayed with the rocks-- googly eyes could even be added to the rocks to make them more "human"!
- **Two rocks (partners) could write an entire conversation between their rocks.



Visualize the Rock Cycle

Create a visual diagram or map to help remember the rock cycle. Organize and illustrate each of these things or events:

sediments
metamorphic
heat and pressure
melting into molten material
weathering and erosion
compacting and cementing

You may add more information and examples to your poster if you like. Remember that color readability are important factors in helping people remember things. Don't forget a title!

Wanted

concept: Rocks can be identified by their physical properties.

Create a wanted poster for your rock. Include a sketch or digital photograph of your rock.

Name:

Description: (color, streak, luster, texture)

Last seen:

Rock Song

Write a "rock song" about the rock cycle. You could write a verse for each group of rocks.

Property Sort

Students practice sorting buttons, blocks, animals, pictures, etc.

Students create a collection of their choice—including a system to classify the objects.

Rockin' Riddles

After researching the properties and uses of your rock or mineral	, write a
riddle using the information that you learned.	

Ex:

From fused ash a deep layer I formed. Later, homes were dug in my canyon wall because I'm not so tough. (answer: Tuff)

Cleavage

materials -- a broken piece of each:

a rock

a piece of soap

a piece of wood

Cleavage refers to the way something breaks. Look at the way each of these materials breaks. Describe the cleavage line of each one. (rough, smooth, jagged, layered, etc.) Rocks are like these materials; they break differently. One way that scientists identify rocks is by looking at how they break.

Rock Similes

Choose any two rocks.

Identify each one and find out how it was formed.

Decide which rock you are most like and why.

Share your ideas with the class:

I'm more like	tha	n
because		

Eroding Rocks

concept: In nature rocks are constantly changing. One way the crust of the earth (including rocks) is shaped is by moving water, such as rivers.

two large plastic jars with lids (quart size- mayo. jar) soft rock or brick hammer plastic bag water

Break the rock into 1 inch pieces by placing it into a bag and hitting it with a hammer. Allow students to look closely at the rocks and record their observations and measurements. Place several (8-10) pieces of rock into one jar with a lid. Fill the jar about ½ to 2/3 with water. Tightly screw the lid onto the jar. Pass the jar around the class allowing each student to shake it 10 times. (You might want to pass the jar around more than once.) Pour the water out of the jar and into a second jar, leaving the rocks behind. Allow the class to make and record their number of shakes as well as their observations of the rock fragments, the inside of the jar, and the water that you poured out.

Discuss: How big are the rock pieces now? Smaller, rounder

How did this happen? abrasion/ erosion

What is in the bottom of the water jar? mud-sediment

In nature-- What would be the rock? rocks/ earth's crust

Where would the water come from? rivers, streams, rain

What would the shaking be? energy/gravity

—running water, waves

If you found a small round rock, what would that tell you? (see activities "Talking Rocks" or "Petrified")

**This process can be repeated several times with fresh water poured into the rock jar and shook again. If you pour the sediment water into the same jar every time, you should begin to see layers of sediment.

Rock Transformation

materials for each student:

2 rocks (preferably a rock that is not very hard-like Tuff)
1 paper towel
1 small disposible cup
1 popsicle/ stirring stick
liquid glue
paper

Give each student a rock. Identify the rock based on its properties.

Discussion questions:

- 1) How was this rock formed?
- 2) Will this rock stay exactly like this forever? (no, the earth's features are always changing)
- 3) Why not? How will it change? (size, shape)
- 4) What will cause it to change? –record students answers (erosion, weathering, earthquakes, humans)
- 5) How fast do rock changes happen? (sometimes quicklyearthquakes, sometimes slowly, weathering)
- 6) Today your job is to transform (change) this rock. How might you do this? --review list of causes
- 7) Which <u>could</u> we do? Which ones would be difficult for us to do? (erosion or human causes would be easiest)
- 8) How could we erode this rock with the tools we have right now? you may wan to add other criteria here, such as "quietly" (rub two rocks together)

Show where you are on the rock cycle and explain that students will BE the changing force. Handout the second rocks and paper towels. Students should begin "eroding" the rock.

9) What are you creating? (sediment)

Collect the sediment and put it into a cup. Hand out cups. Keep eroding!

10) Is it easy or difficult? Have you discovered how to speed up the process?

Have students keep working to create enough sediment to fill their cup about half way!

11) You have a lot of sediment! What happens next in the rock cycle? (minerals mix with the rock and cause it to harden)

Add glue (symbolizing minerals) to the sediment and mix with the stick. It should be the consistency of clay—not too sticky—so that students can shape it with their hands.

12) What forces shape rocks in the earth?

Allow the students to create their own shape, set it on paper and let it dry. (It can be placed in the oven and baked.)

** If digital pictures are taken during the process, they can be taped to the rock cycle or be used to create your own "rock cycle."

<u>ID Card</u> (see worksheet) concept: Rocks can be identified by their physical properties.

Create an identification card for your rock. Your information should be clear so that your rock can be easily identified! If the cards are read, can the rocks be identified out of a large group?

Rock ID Card

	name:	
	kind of rock:	
	rock group:	
	mass:	
texture:	color:	- 1
streak:	hardness:	
shaped by:		
uses today :		

Rock Hunt- Primary

Go out on your own playground to "rock hunt." Hand out baggies and "Rock Hunt" forms. Read each clue together.

Find a rock that is:

- 1) smooth
- 2) rough
- 3) different colors
- 4) one color
- 5) with stripes

Explain that when they find a rock that fits a clue, they should put it in their bag.

After about 15 minutes of searching outside, return to class. Did anyone find a rock for each description? Choose your favorite rock from your bag. Why is it your favorite? Students may turn and tell a partner about their rock or the class may "circle up" and take turns sharing.

Touch the earth and listen to the rock
For they remember
They know and remember all that has come to pass here.

Lee Henderson